

IN THE CLAIMS

Please amend the following claims.

1. (Currently Amended) An apparatus, comprising:
a carrier substrate having a visible surface and a heat generating component electrically coupled to the carrier substrate;
a thermochromatic material having an activation temperature, disposed adjacent to the carrier substrate, wherein the thermochromatic material produces a visual change of the visible surface when the activation temperature of the thermochromatic material is reached; and
a solder mask layer, wherein the solder mask layer is transparent and overlaying the thermochromatic material adjacent to the carrier substrate,
wherein the carrier substrate coupled to the heat generating component has normal operating temperatures when the carrier substrate and heat generating component operate normally, and
wherein the thermochromatic material is selected to have its activation temperature above the normal operating temperatures of the carrier substrate coupled to the heat generating component;
wherein said thermochromatic material comprises a material selected from the group consisting of leucodye and N-isopropylacrylamide to change from a first color and a second color.

2. (Original) The apparatus of claim 1, wherein the carrier substrate comprises a printed circuit board.

3. (Currently Amended) The apparatus of claim 1, wherein the solder mask material has similar properties to that of the thermochromatic material.
4. (Currently Amended) The apparatus of claim 1, wherein the thermochromatic material comprises a leucodye to change from [[a]] said first color to [[a]] said transparent state.
5. (Currently Amended) The apparatus of claim 1, wherein the thermochromatic material comprises N-isopropylacrylamide to change from [[a]] said first color to [[a]] said transparent state.
6. (Original) The apparatus of claim 1, wherein the thermochromatic material comprises a liquid crystal to change from a first color to a second color.
7. (Previously Presented) The apparatus of claim 1, wherein the thermochromatic material is integrated with the solder mask.
8. (Previously Presented) The apparatus of claim 1, wherein the carrier substrate comprises a signal layer electrically coupled to the heat generating component, and wherein the solder mask material and the thermochromatic material are mixed to form a single mixed layer above the single layer.
9. (Previously Presented) The apparatus of claim 1, wherein the carrier substrate further comprises component identification markings printed on the carrier substrate with the thermochromatic material underlying the solder mask layer.
10. (Currently Amended) A printed circuit board, comprising:
a signal layer electrically coupled to a heat generating component;

a solder mask layer disposed above the signal layer, wherein the solder mask layer is transparent; and

a thermochromatic layer disposed over the signal layer and under the solder mask layer, wherein the thermochromatic layer has an activation temperature to change a visible surface of the printed circuit board from a first visible state to a second visible state,

wherein the printed circuit board has normal operating temperatures when the printed circuit board operates normally, and

wherein the thermochromatic layer is selected to have its activation temperature above the normal operating temperatures of the printed circuit board;

wherein said thermochromatic material comprises a material selected from the group consisting of leucodye and N-isopropylacrylamide.

11. (Original) The printed circuit board of claim 10, wherein the first visible state comprises a first color and the second visible state comprises a second color.

12. (Original) The printed circuit board of claim 11, wherein the thermochromatic layer comprises a liquid crystal material.

13. (Currently Amended) The printed circuit board of claim 10, further comprising identification marking printed on the substrate with thermochromatic material.

14. (Original) The printed circuit board of claim 10, wherein the thermochromatic layer comprises a leucodye material.

15. (Original) The printed circuit board of claim 10, wherein the thermochromatic layer comprises N-isopropylacrylamide.

16. (Previously Presented) The printed circuit board of claim 10, wherein the thermochromatic material and the solder mask material have similar physical properties.

17. (Previously Presented) The printed circuit board of claim 10, wherein the solder mask material and the thermochromatic material are mixed into a single mixed layer above the signal layer.

18. (Previously Presented) The printed circuit board of claim 16, wherein the thermochromatic layer is integrated with the solder mask layer.

19. – 29. (Canceled)

30. (Currently Amended) A detection apparatus, comprising:

- a carrier substrate having a visible surface;
- a heat generating component electrically coupled to the carrier substrate;
- a thermochromatic material, adjacent the carrier substrate, for detecting heat from the component, which is in excess of normal operating conditions; and
- a solder mask layer, wherein the solder mask layer is transparent and overlaying the thermochromatic material adjacent the carrier substrate,

wherein the carrier substrate electrically coupled to the heat generating component has normal operating temperatures when the substrate and the heat generating component operate normally, and

wherein the thermochromatic material is selected to have an activation temperature above the normal operating temperatures of the carrier substrate coupled to the heat generating component, and

wherein the thermochromatic material provides a visual thermal differential of those areas on the carrier substrate electrically coupled to the heat generating component with temperatures above its normal operating temperatures;

wherein said thermochromatic material comprises a material selected from the group consisting of leucodye and N-isopropylacrylamide.

31. (Previously Presented) The detection apparatus of claim 30, wherein the carrier substrate is selected from the group consisting of: printed circuit boards (PCB), motherboards, daughterboards, controller boards, video adapters, and network interface cards.

32. (Previously Presented) The detection apparatus of claim 30, wherein the heat generating component is selected from the group consisting of: processors, chipsets, graphic chips, voltage regulator components, and any combination thereof.

33. (Previously Presented) The detection apparatus of claim 30, wherein the activation temperature is between about 30°F and about 200°F.

34. (Previously Presented) The detection apparatus of claim 30, wherein the visual thermal differential is useful in providing diagnostic and identification procedures.

35. (Previously Presented) The detection apparatus of claim 34, wherein the visual thermal differential is useful for identifying inefficient heat dissipation.

36. (Previously Presented) The detection apparatus of claim 34, wherein the visual thermal differential is useful for identifying the elevated temperature of a defective component coupled to the carrier substrate.

37. (Previously Presented) The detection apparatus of claim 30, wherein the thermochromatic material comprises a combination of color changing inks.

38. (Currently Amended) The detection apparatus of claim 30, wherein the a solder mask material is part of the visible surface.

39. (Previously Presented) The detection apparatus of claim 38, wherein the solder mask material has similar properties to that of the thermochromatic material.

40. (Previously Presented) The detection apparatus of claim 38, wherein the carrier substrate comprises a signal layer electrically coupled to the heat generating component, and wherein the solder mask material and the thermochromatic material are mixed to form a single layer above a signal layer.

41. (Currently Amended) A diagnostic detection apparatus, comprising:
a heat generating component electrically coupled to a carrier substrate having a signal layer, wherein the carrier substrate electrically coupled to the heat generating component has normal operating temperatures when the carrier substrate and heat generating component operate normally;
a thermochromatic layer above the heat generating component and under a solder layer, wherein the thermochromatic layer is selected to have an activation temperature above the normal operating temperatures of the carrier substrate coupled to the heat generating component;
a means for producing a visible change of the thermochromatic layer when the carrier substrate coupled to the heat generating component is operating above the normal operating temperatures of the heat generating component; and
a means for observing said visible change of the thermochromatic layer;
wherein said thermochromatic material comprises a material selected from the group consisting of leucodye and N-isopropylacrylamide.

42. (Previously Presented) The diagnostic detection apparatus of claim 41, wherein the solder mask layer further comprises thermochromatic material mixed into the solder mask material and having an activation temperature above the normal operating temperature of the heat generating component electrically coupled to the substrate.

43. (Previously Presented) The diagnostic detection apparatus of claim 41, wherein the carrier substrate is selected from the group consisting of: printed circuit boards (PCB), motherboards, daughterboards, controller boards, video adapters, and network interface cards.